NEWSLETTER

DIGNAN PHOTOGRAPHIC INC., 12304 ERWIN ST., NO. HOLLYWOOD, CALIF. 91606

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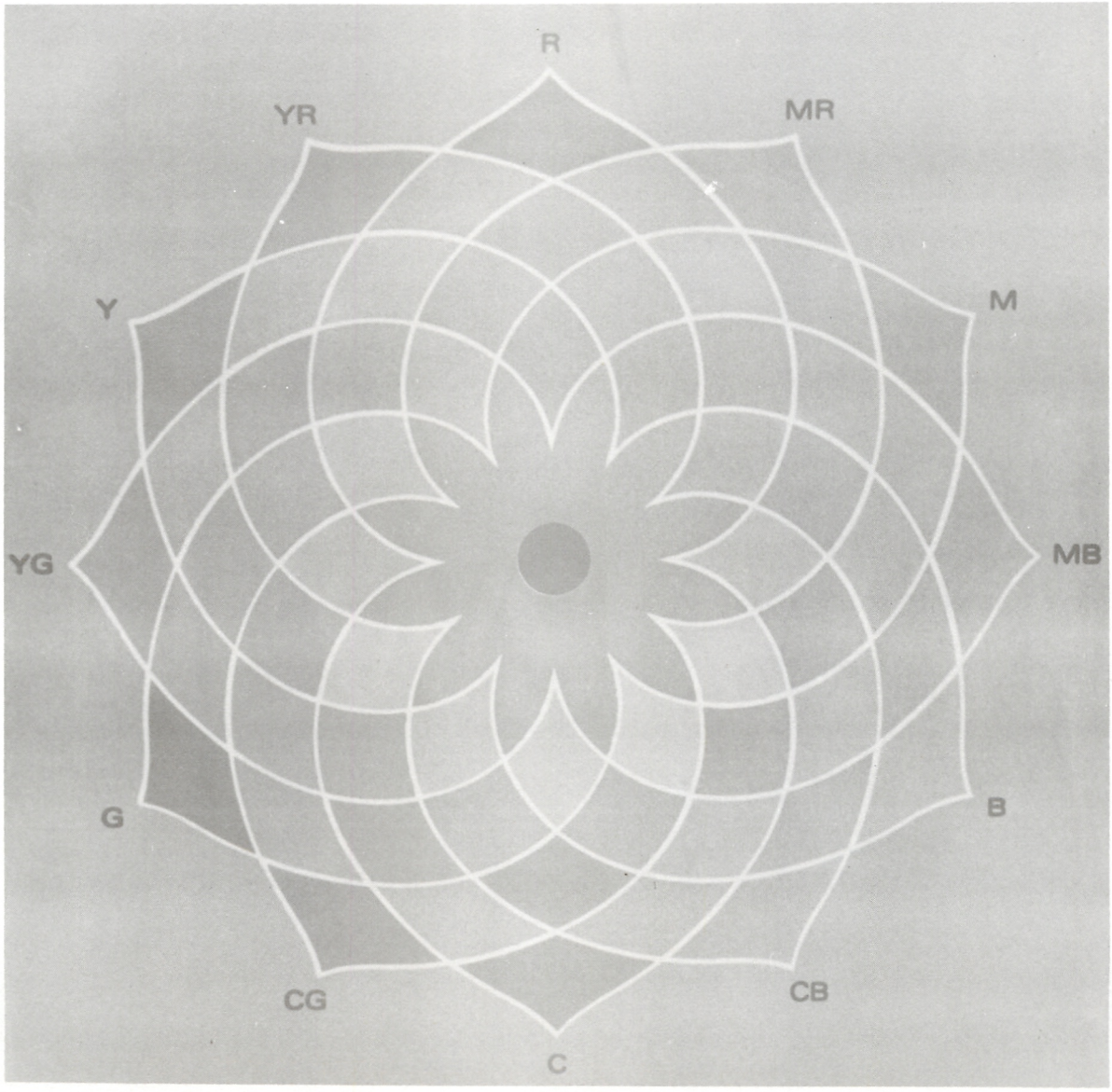


Tuesday Something-Or-Other

Dignan Photographic
12304 Erwin Street
No. Hollywood, CA 91606

Attention: Pat Dignan

Dear Pat:

You've been asking me for several weeks, "When are you going to write another article for the Newsletter?". Well. Pat, my erstwhile friend, I have no intention of ever writing another article for you, much less anyone else! You see, for the past several days I've been sitting in a dark room (not a darkroom, but a dark room), where I've been contemplating the compounded errors of my many ways. Why in the name of George Eastman I didn't take up any other profession is the mystery . . .

You see, Pat, in photography there is an old saying (that I just made up) which goes: "If you want to find trouble in the darkroom, you've not far to look!" And man, have I ever been having trouble, and all because I got a bit curious and snoopy. The trouble? Color printing is the current trouble, and, as of right now, I'm almost ready to concede that Ansel Adams is right -- black and white is the only way to fly!

Ah, I can hear your laboured breathing right now! You're probably on the verge of a well-deserved stroke. And simply because I am attacking everything you and Dignan Photographic stands for --- photography, photochemistry, color printing, the works. Well, you want to know something? I don't give a good rap in you-know-where, because I am through, through, through with color printing! You want to know why? I'll be delighted to tell you, but an article you are not going to get. Instead I'm looking over the want-ads right now. There's a nice position open at an Orange Julius stand. Maybe my true calling is in chili-dogs . . .

Anyhow, here is the problem, and I hope it haunts you and keeps you awake at night just the same as it has been doing to me. You see, the other day I decided to "program" a new box of color printing paper. I'll not bother to mention the name of the manufacturer. It makes no difference. I'm convinced that none of them make a good product. They steal and copy from each other, and from the same patents. Nothing new about that, I suppose, because it has always been a "me too" type of business . . .

Anyhow, as I said, there I was, trying to "program" that blighted box of color paper. My first try resulted in a print which was too magenta. So, according to the books, you add magenta to subtract magenta, right? Right! So, I said to myself, "How much magenta is in error?" And I answered, "On the order of .10M". So, I added a .10M filter to the pack, made another print, and now the thing was

too green. Obviously I had added too much magenta, thus subtracting too much magenta which, in turn, added the complement to the print, or, in this case, green --- a nice sickly green. So, I took out the .10M filter, and replaced it with a .05 filter. I made yet another print, however, it was now too magenta. Well, I reasoned that this, too, was not right, so I thought a .025 filter would put me right in the old ball game (to coin a phrase . . .). So I took out the .05 filter, and replaced it with a .025M filter. Now, I made another print and so help me, now it was slightly yellow!

Right! I added a bit of yellow, I mean I subtracted a bit of yellow (I am still confused), and made another print. Now the damn thing was slightly blue/green. You must understand, at this point, that I am using up copious quantities of costly color print paper. Frankly, I am beginning to feel put upon. Wouldn't you? Ahhhh, I don't give a d--- about what you may think!

So, in an effort to put this "thing" into some sort of perspective, I decided to analyze the CP filters because they had become highly suspect. A densitometer was taken out of the closet, set up, properly zeroed, and the filters were read out. I must tell you here and now that if filters are all like this, I am certain that I shall never again try to make another color print by the eyeball method. For example, I took my starting filter pack (.20M + .85Y), and placed them on the densitometer's table. Then, I read out the combined Red, Green, and Blue densities. This is what they were, and I am not trying to put you on: Red .11, Green .42, Blue 1.00. In terms of printing filters used, this is what it was:

CYAN	MAGENTA	YELLOW
.11	.42	1.00

Imagine, cyan in a magenta and yellow printing pack. Knowing that equal amounts of all filtration will cancel each other out (neutral density) I subtracted .11 from all the readings. This left the following values:

M	Y
.31M	.89Y

That is a far cry from the marked values of a .20M and .85Y. It represents an increase,over marked values, of .06M and .04Y. And if you don't think that makes a difference in your prints you are slightly mad . . .

No, I amend that. You are absolutely mad. And so is every poor sap who ever tries to zero in a strange box of color printing paper --- or at least to zero it in without using up half the box. To confirm my observations, I took a brand new .50M and a .50Y (which added up to .50 Red), and read them out on the densitometer. The true values were:

M	Y
.45	.65

That was pure revelation, also pure frustration! So, I took a .50C filter and read it out. This is the result:

M	C	Y
.52	.16	.10

Why continue. At this point I was so confused, so angry, so upset, that I swore a mighty oath (I'm real good at mighty oath swearing). I'll never again make another color print. Don't you see what I've been getting at? Color printing is a total impossibility. If, and that's a mighty big if, if you ever do get a perfect color print, you can be assured that it is one in a million, and that it'll never happen again.

Look at it this way. No color print paper is perfect, nor can it give you perfect color reproduction. "They" all admit that. (Those damned eternal "They".) Add to this fact that a degree or two from required processing temperature can alter the results, throw in the fact that a color emulsion changes on an almost daily basis (minimal, true, but a change nevertheless). Confuse the whole business by saying that no two developers can do the same job --- even though they may come from the same manufacturer (the law of variability says that no two things, no two events, can be identical), and then you can throw in those blighted filters which also change color upon exposure to light and humidity, and, well, you can see what a miserable mess I have gotten myself into. And all because I got curious (magenta, cyan, and yellow)!

Ha, it also occurs to me that even the dyes in a perfect print are fugitive to a certain extent, and they can, and will, change upon lenghty exposure to light and humidity. What are you supposed to do? Keep your color prints in Jack Benny's vault? Ridiculous!

You know, I'm told that yellow filters approach being .90% perfect, and that magenta filters approach 75-80% efficiency. I don't know how trite that statement may be, but, in the area of cyan Im' told that these filters are supposed to screen out red (magenta and yellow). However, they pass about 50%, or even more of the red than marked. This means they are highly inefficient in screening out any stray infra-red. And infra-red response is high in many color papers.

I'm also told that some color papers are sensitive to U.V. radiation. Seems as how your best bet would be to use a highly efficient U.V. and I.R cut off set of filters. You mentioned the I.R. cut off filter which is sold by Rapid Access. I suppose it is probably excellent. I'm also told that Berkey has an excellent I.R. cut off filter in their Colortran. I wonder if it is available by itself? Apparently you must deal with the visible spectrum only if you want acceptable prints, and even instrumentation used to analyze color negatives cannot detect U.V. and I.R. radiation.

Speaking of those color analyzers, well, they are simply not true. They don't analyze anything --- they are only color comparators at best. In fact, no matter the price tag which may be appened to the instrument, be it $29.95, or $2,995.00, their respective instruction books all begin the same --- "First, make a perfect color print by trial and error . . ."Hell, if I could do that, who needs their fool machines? Damn silly way to run a railroad if you ask me.

Right now I'm entertaining the thought of tri-color printing. I believe the use of three filters, instead of dozens, may be the answer to most of the problems. Many old hands swear that the additive system gives you better saturation, and better color control. They may be right. Although the subtractive system, in theory, offers a lot more flexibility (printing control such as dodging or buring in). However, who can stand the financial gaff in trying to program a new box of color printing paper? I know, you maintain that when buying paper you should buy as much of the same emulsion number as is financially possible. However, I maintain there must be an easier way . . .

So, maybe one of your super-bright readers knows the answer. Until that bright and shining day, I'm now totally committed to black and white printing. Black and white is beautiful. . .

Yours,

Paul Farber

P.S. Write an article for you? Don't be silly!

AGFACOLOR DUPLICATING FILM

By Adrian Vance

Remember a few years ago when the photographic world began to rave about the quality of Agfachrome color reproductions in magazines? I have just finished a study of one of the Agfa-Gevaert emulsions that demonstrated why there was so much bragging. (See "My Wonder Film" by D. William Reichner, January 1969 Newsletter.) My conclusions include that: (1) This material has an extended range, about seven stops. (2) The gamma remains constant through a wide variation of first development times, but the range, color saturation and acutance, as well as exposure index, change. (3) At the optimum exposure index, the acutance of this film is on a par with Kodak's Panatomic X. (4) The grain structure is only a shade more coarse than Kodakchrome II and in most exposures both films appear grainless. (5) Agfa chemistry is fun.

"Agfa chemistry is fun?" Yes. In most color kits you will find more bottles, bags, packs and ampules than in a drug runner's carpet bag. As you work your way through the Agfa kit, you begin to acquire the uneasy feeling that something has been left out. It hasn't. I made careful weighings of the contents and you should be able to use my figures to prepare 500 ml quantities of the solutions. Each 500 ml will process four rolls of 36 exposures, in a one shot rotating tank system. Weigh the indicated solid and dissolve completely before adding the next solid or liquid. In each case, start with 400 ml of water and add the chemicals. Finally, fill the bottles to 500 ml.

FIRST DEVELOPER:	A - 4.25g, B - 45g, C - 3ml
COLOR DEVELOPER:	Al - 0.5g, A - 2.5g, B - 39g, C - 7.5ml
STOP:	16g,
BLEACH:	64g
FIXER:	72g

Believe it or not, that is it! That is the regular Agfa Chemistry that produces the slides that people rave about!

"But they don't have any clearing baths and hardeners and stabilizers and, and..." No. Apparently Agfa believes in the effectiveness of one of the more readily available darkroom chemicals - water. Some of the washes are incredibly long if you are used to the Eastman or Ansco systems, but it works. Furthermore, the film is tough and I didn't see any emulsion separation or flaking throughout the study. For my main test, I exposed four rolls of film in an identical manner. All four contained a full gray scale, photographed in seven exposures with rated indices from 250 to 4, and a normally lit outdoor scene, including a resolution test chart. The outdoor scene was also covered in seven exposures from EI 250 to 4. The first roll was processed in the first developer for four minutes, the next roll for eight minutes, the next for 12 minutes, and the last for 16 minutes. Each roll was rinsed and stopped according to directions and held in a wash tank until all four rolls were ready to be processed in the remaining solutions together.

Agfa recommends that the first developer be used for four minutes. After this the film is rinsed for ten seconds and then covered with the stop bath for three minutes. The wash time is given as seven minutes and the re-exposure, which I do on the Nikkor reels, is directed for 15 seconds. The color developer is used for nine minutes and this is followed by a 14 minute wash. The bleach, its following wash, and the fixer all share four minutes in the tank, consecutively of course, and the last wash is for ten minutes. The film drys in about an hour. I used Photo-Flo before hanging the film, but I understand that three drops of liquid detergent per quart of water will do just as well.

As soon as the film was dry, I made the instrument readouts and recorded the data. This information is as follows:

First Developer	E.I.	Res. x Pan. X	Gamma	Shift	Correction
4 minutes	10	0.93N	1.1	none	none
8 minutes	40	1.00N	1.1	none	none
12 minutes	70	0.79N	1.1	cyan	05M+20Y,R1.5
16 minutes	125	0.65N	0.76	cyan	10M+30Y,R3

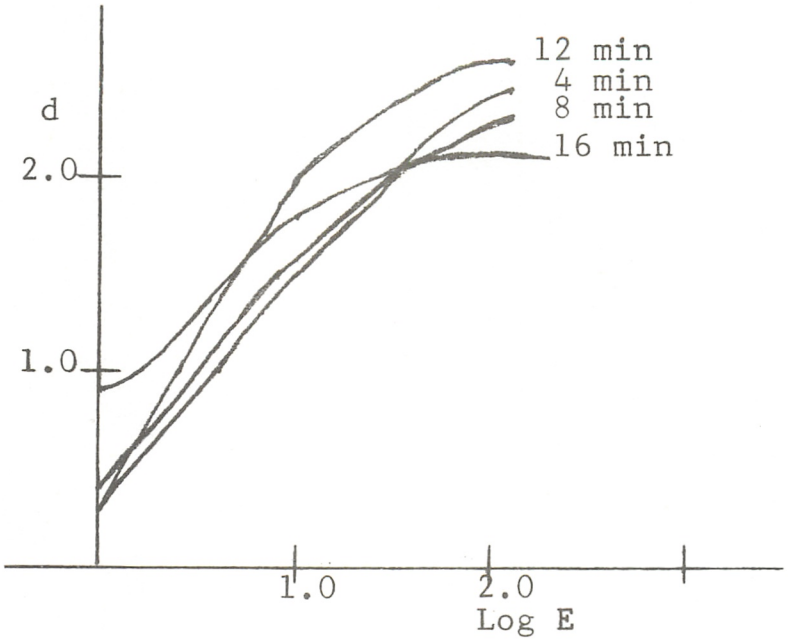
The resolution is correlated to Panatomic X as most people who test lenses use this material and a given number of lines per millimeter from my camera would probably not translate directly to your camera. In the 12 and 16 minute batches, the corrections are first given in standard filter pack terms and in decamired filter numbers. The H&D curve for the 12 minute batch compares pretty well with the others, but the 16 minute curve shows very high fog and poor saturation. If you graph the readouts, you will see that a development time of nine and one-half minutes will produce an exposure index of 50 and the resolution would probably compare with Panatomic X. I would expect to see no color shift and good, solid saturation. This is an excellent system.

Agfa - Dub

First Developer	E.I.	Lines/mm x Pan X	Gamma	Shift	Correction
4 minutes	10	57	0.93N 1.1	none	none
8 minutes	40	61	1.00N 1.1	none	none
12 minutes	70	48	0.79N 1.1	cyan	0.05M+0.20Y
16 minutes	125	39	0.65N 0.76	cyan	0.10M+0.20Y

***

Scale	4 min	8 min	12 min	16 min	Scale	4 min	8 min	12 min	16 min
0.00	0.33	0.30	0.33	0.94	1.00	1.50	1.65	1.90	1.76
0.10	0.36	0.39	0.43	0.94	1.30	2.00	2.02	2.12	2.10
0.20	0.43	0.55	0.55	0.98	1.60	2.35	2.18	2.52	2.10
0.30	0.55	0.64	0.72	1.12	Base	0.12	0.12	0.12	0.85
0.50	0.80	0.98	1.20	1.35	Flesh	0.64	0.64	1.27	1.35
0.70	1.05	1.24	1.46	1.50					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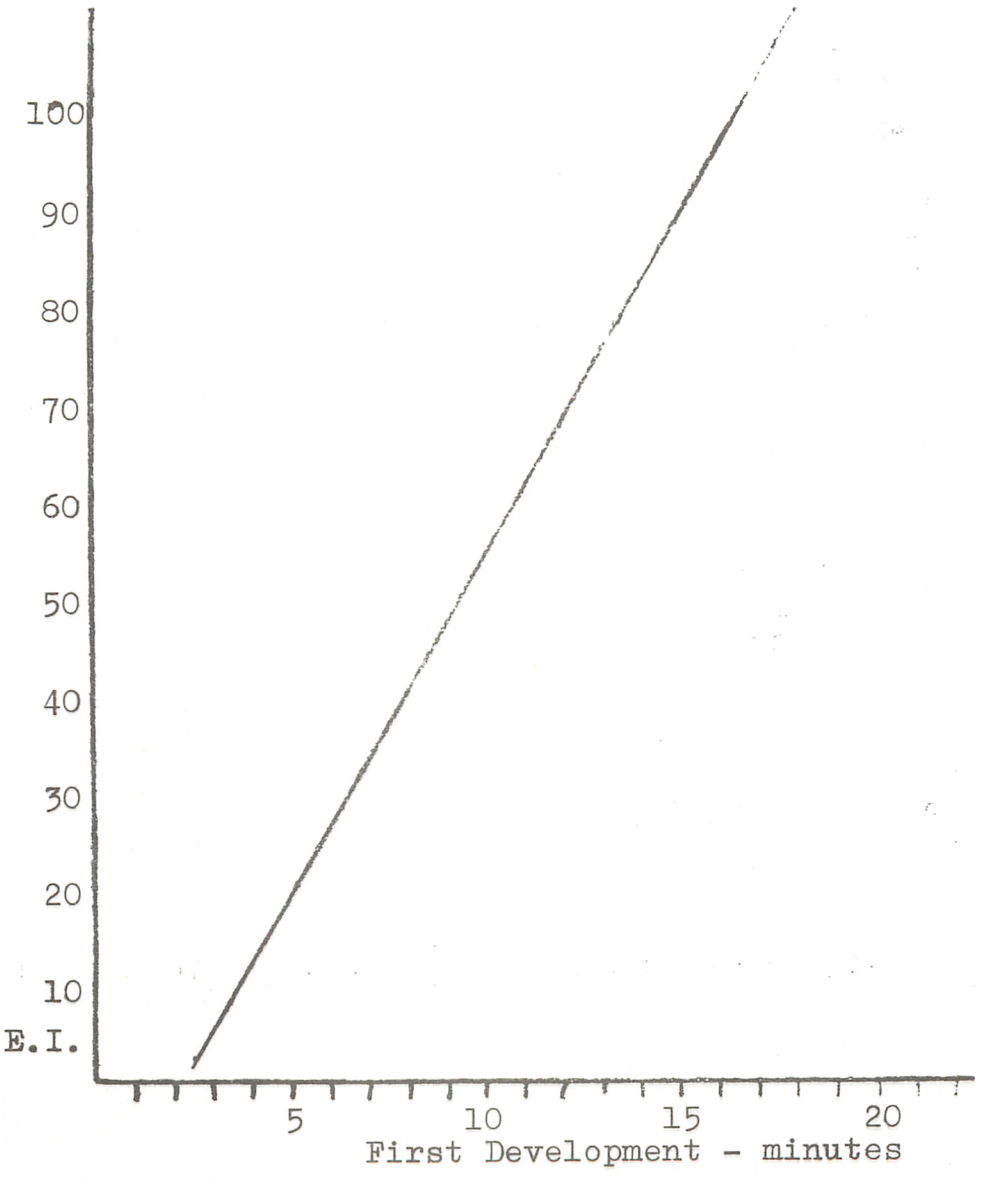
100
90
80
70
60
50
40
30
20
10
E.I.
5
10
15
20
First Development - minutes

THE MITCHELL COLOR WHEEL SYSTEM

As we have pointed out many times, a color transparency or a print is technically correct when it can reproduce "true gray" as in a chart of a gray scale.

Kodak Color Guide Book contains a gray scale and color chips. It also contains a model so that you can evaluate skin tone. If a gray scale can be reproduced as a true gray, and if you have divisions between all the steps of the gray scale from black and white, you can be reasonably sure you have technically reproduced the picture correctly. We have underlined technically because being technically correct may not be artistically pleasing, but it is an easy matter to make minor artistic changes after you become proficient at color printing a gray scale.

The "Mitchell Color Wheel System", manufactured by Heath Corp., consists of a 15-page booklet of instructions plus the color wheel (see cover which is a black and white reproduction).

A gray card error produces a color cast. The color wheel is a color chart made up of mistakes of gray. The booklet recommends that you use the color wheel to read the gray part of a test color print.

The color wheel contains a center circular hole which is placed over the test print. At this point, you will find it very easy to see where you are off in color balance. You then refer to black and white reproduction of the wheel in the instruction manual. It will tell you which filters to add or subtract so that you can get closer into balance.

Mitchell assumes that most negatives contain a natural gray. To utilize the system, search your file for a negative that you recall contains gray, or better still, photograph the 50% gray reflective card that Mitchell recommends for use with the Colorval. This card should sell with the color wheel system; unfortunately, it doesn't. One of our subscribers overcame the problem quite easily. He photographed a close up of the color wheel and uses the gray background as his gray.

As we said in last months Newsletter, (Rapid Access, page M-265) the booklet explains how to eliminate the unwanted UV and IR light rays. The Mitchell system eliminates the calculation of neutral density, so that you will be doing most of your color printing using only yellow and magenta filters. In the Rapid Access story, we listed the values of the various IR filters, but remember the IR filters replace the infra-red glass, at least in part. So, if your enlarger is already equipped with heat-absorbing (IR) glass, try one IR filter. If you are using unmasked negatives, you probably will find that you will not need the IR filters.

THE MITCHELL COLOR WHEEL SYSTEM

The instruction booklet not only takes you very rapidly through some basic color enlarging information, it also tells you what darkroom equipment you will need so that you can make a good start in the right direction.

Color printing is not easy. Much will depend on your past experience. If you will think back to your first black and white session, perhaps you didn't produce an Ansel Adams the first time.

Mitchell, in the booklet, makes a rather startling statement. He almost guarantees that you will be in color balance after using only one sheet of 8" X 10" paper! Much of your success will depend on how well you follow his very explicit directions. The system has worked for us, and we feel it will help simplify your color printing.

KODAKS BIG SECRET ---- KODACHROME

By Patrick D. Dignan

If Eastman Kodak had produced the first atom bomb, we are certain that the Russians would never have produced one. The Kodachrome process is perhaps the best kept secret since the sphinx.

We are listing two sets of official Kodachrome formulas. The first set was for the processing of Kodachrome duplicating film type 5265 (16mm print film). This film was produced from 1944 to 1955. The second set was for processing film type 5268 which was produced from 1946 to 1958. This film had an E.I. of 10 for tungsten 3200K. It produced low contrast originals for making prints (16mm). It was replaced in 1958 by commercial Ektachrome type 7255.

Why two obsolete sets of formulas? At this time, we do not have K-11 which we understand is used by Dynachrome or the newer K-12 series used by Kodak and its licensees. The present system is designated K-12D which indicates that there is a constant flow of modifications pouring out of the Kodak factory. We are in hopes of receiving K-11 and K-12 and we will publish these when we do. We are publishing the enclosed formulas so that you can study and compare them.

Although the source of our information is excellent, we feel that certain parts of it leave something to be desired. As an example, from our experience, the first developer should contain thiocyanate. Note that these formulas do not. We have run into this problem of missing information in reading chemical patents. Sometimes the order of mixing has been reversed making it impossible for the novice to successfully compound a solution. We have also seen it in published formulas where the chemical names are listed incorrectly, "sulfite" reading "sulfate", etc. So at this time, we do not recommend that you go out and start mixing these Kodachrome solutions. We are listing some of our thoughts on these formulas in the notes starting on page N-293. We are also listing ALL of the couplers now sold by Kodak, presumably used in K-12 and possibly K-11.

We have not tried these formulas and we do not plan to do so. We are afraid it takes a sturdier heart than we possess. In fact, Kodak could release the formulas they are now using and we sincerely doubt that more than one or two experimenters in the country would pickup the challenge.

For the difference between a Kodachrome type emulsion and an Ektachrome type emulsion, we refer you to our article entitled "A Review of a Few Basic Rules and Facts About Color Processing" starting on page K-219 of the July 1969 Newsletter.

As we have pointed out, the Kodachromes do not contain color couplers. The color couplers are in the developing solutions. This type of emulsion is referred to as "substantive". Ektachrome type emulsions contain couplers and are called "non-substantive".

KODACHROME

Today, because the patents on the original Kodachrome are public domain, Agfa-Gavaert, Ilford, Dynachrome and Fugi manufacture this type of emulsion. We might add that they also manufacture a number of emulsions of the Ektachrome or Agfachrome type in which the couplers are in the emulsion. Knowing which is which is part of the game called "How Is It Processed?" Although a Kodachrome type of emulsion is easier to manufacture, it is much more difficult to process as you will soon discover. The three sensitive layers in this type of film are in the following order. The top layer is blue sensitive, producing yellow. The middle layer is green sensitivie, producing magenta. The bottom layer is red sensitive, producing cyan.

Each manufacturer produces a substantive emulsion slightly different from each other. This slight difference can make a big difference in the final results.

First of all, the film probably has an anti-halation layer on the back similar to Eastman color films which may be removed before or after first development, depending on the system used. The anti-halation layer may also be the first layer on the base side composed of finely divided black silver which is removed in the bleach and fixer solutions. The film may also have a collodial silver filter layer between the top blue sensitive layer and the green sensitive middle layer.

Here Is How It Is Processed

In the processing of Kodachrome, the first developer is a black and white type very similar to those used in all reversal systems. After the first developer, the film contains a black and white negative in all three layers. It also contains the unexposed positives. (In fact, about the simplest thing you can do with this type of film, is develop it to a black and white negative. After fixing and washing, you will have a negative, however, the printing results will probably be very unsatisfactory.)

To produce the positive color, some means must be used to re-expose each layer independently of each other and then process it in a developer which contains the appropriate color coupler or couplers.

After the first developer, the emulsion is exposed from the back only to a very narrow cutting red filter. This exposes the red sensitive layer next to the base. Because the positive image in the bottom layer is the only layer that is exposed during the re-exposure to the red filter, it is the only layer, at least in theory, that will develop. After this exposure, it enters a cyan color developer. For reasons to be explained, the film may enter a second developer called an auxiliary developer.

KODAKCHROME

After the cyan developer, the film is exposed from the top or front to a narrow cutting blue filter. This exposes the positive top layer only. Care must be taken to make sure that the blue light is not reflected to the back side which would expose the middle magenta layer.

The film then enters the yellow color developer. In the two systems listed, another auxillary developer follows the yellow developer. We have now exposed and color developed the bottom red sensitive layer to cyan and the top blue sensitive layer to yellow. This leaves the middle green sensitive magenta layer unexposed and undeveloped. The film at this point is extremely insensitive to light. It must be remembered that all of the silver halide in the bottom layer and all of the silver halide in the top layer has been changed to black silver.

To expose the middle magenta layer, the film is subjected to bright white light from both the front and back. After this exposure, the film enters the magenta developer after which the film is bleached and fixed. These last two solutions remove all of the silver, leaving only the developed dye of the positive in the three layers. In explaining the system, we have left out the 8 washes that are, of course, a necessary part of the process.

OFFICIAL KODAK PROCESSING FORMULAS FOR KODACHROME DUPLICATING COLOR FILM TYPE 5265

Step	Processing Solution	Time
1.	Prehardener	2 min
2.	Wash	2 min
3.	First Developer	6-7 min
4.	Wash	4 min
4A.	NOTE: Red light exposure through the base (Corning 2410 filter 3mm thick) approximately 2,100 ft. candles.	
5.	Cyan Developer	11 min
6.	Wash	4 min
6A.	NOTE: Blue light exposure emulsion side (Wratten 39 Filter 2mm thick) approximately 14,000 ft. candles.	
7.	Yellow Developer	6.25 min
8.	Wash	2 min
9.	Auxiliary Developer	4 min
10.	Wash	2 min

OFFICIAL KODAK PROCESSING
KODACHROME TYPE 5265

Step	Processing Solution	Time
11.	Sound Track Developer	10 sec
12.	Wash	2 min
13.	Magenta Developer	6.25 min
14.	Wash	6 min
15.	Bleach	4 min
16.	Fix	2 min
17.	Wash	6 min
18.	Dry	20 min

NOTE: All solutions at 70°f.

PREHARDENER

Calgon	.6	gram
Sodium Bisulfite	5.0	grams
Sodium Carbonate (mono.)	5.0	grams
Sodium Sulfate (anhy.)	150.0	grams
Potassium Bromide	1.0	gram
Formalin	20.0	cc
Sodium Hydroxide	.21	gram
Water to	1.0	liter

FIRST DEVELOPER

Calgon	.6	gram	
Sodium Bisulfite	10.0	grams	
Elon (Same as DD-4)	4.8	grams	
Hydroquinone (Same as DD-14)	2.0	grams	
Sodium Carbonate (mono.)	30.0	grams	
Sodium Sulfite	63.5	grams	
Potassium Bromide	3.25	grams	
Potassium Iodide (0.1% sol.)	20.0	cc	
Isopropylamine (100%)	6.55	grams	(See note #2*)
Water to	1.0	liter	

See Note "A"*

CYAN DEVELOPER

Calgon	.6	gram	
Foamex (wetting agent)	.4	cc	(See note #3)
Alkanol B	.3	gram	(See note #3)
Sodium Sulfite	20.0	grams	
2-amino-5-diethylamino toluene hydrochloride (CD-2 or DD-2)	1.75	grams	

(continued)

*Notes for both systems appear on page N-291

OFFICIAL KODAK PROCESSING
KODACHROME TYPE 5265

CYAN DEVELOPER (continued)

Sodium Carbonate (mono.)	25.0	grams	
Sodium Thiocyanate (50% solution)	6.0	cc	
Potassium Bromide	1.0	gram	
Sodium Hydroxide	4.6	grams	
6-nitrobenzimidazole nitrate	.3	gram	
2, 6-dibromo-1, 5-dihydroxy naphthalene	1.45	gram	(See note #5)
Mono-N-benzyl p-aminophenol hydrochloride	1.15	gram	(See note #8)
Potassium Iodide (0.1% sol.)	3.0	cc	
Water to	1.0	liter	

See Note "B"

YELLOW DEVELOPER

Calgon	.6	gram	
Sodium Sulfite	5.0	grams	
2-amino-diethylamino toluene hydrochloride (CD-2 or DD-2)	.6	gram	
Sodium Sulfate	25.0	grams	
Sodium Carbonate (mono.)	42.0	grams	
Potassium Bromide	1.0	gram	
Sodium Thiocyanate (50% sol.)	1.7	cc	
Potassium Iodide (0.1% sol.)	17.0	cc	
6-nitrobenzimidazole nitrate (1.0% sol.)	1.0	cc	
Sodium Hydroxide	3.0	grams	
4-p-toluene sulfonylamino-omega-benzoyl acetanilide	2.25	grams	(See note #6)
Water to	1.0	liter	

AUXILIARY DEVELOPER

Calgon	2.0	grams	
Sodium Bisulfite	8.3	grams	
Elon (Same as DD-4)	3.5	grams	
Hydroquinone (DD-14)	2.25	grams	
Sodium Carbonate (mono.)	30.0	grams	
Sodium Sulfite	63.5	grams	
Potassium Bromide	2.5	grams	
5-nitroindazole (0.5% sol.)	2.0	cc	(See note #1)
Potassium Iodide (0.1% sol.)	20.0	cc	
Isopropylamine (100%)	5.20	grams	(See note #2)
Sodium Thiocyanate (50% sol.)	5.5	cc	
Water to	1.0	liter	

OFFICIAL KODAK PROCESSING
KODACHROME TYPE 5265

SOUND TRACK DEVELOPER

Sodium Sulfide ($Na_2S.3H_2O$)	20.0	grams
Ethyl Alcohol	250.0	cc
Distilled water to	1.0	liter

MAGENTA DEVELOPER

Calgon	.6	gram
Sodium Sulfite	18.0	grams
2-amino-5-diethylamino toluene hydrochloride (DD-2 or CD-2)	1.75	gram
Sodium Sulfate	15.0	grams
Sodium Thiocyanate (50% sol.)	12.4	cc
Ethylene Diamine (68-70% by wt.)	5.0	cc
Sodium Carbonate (mono)	40.0	grams
Potassium Bromide	1.45	grams
Sodium Hydroxide	1.50	grams
1-(2 benzothiazoyl 1)-3-amino-5-pyrazolone	.50	gram (See note # 7)
Water to	1.0	liter

FERRICYANIDE BLEACH

Calgon	.6	gram
Potassium Ferricyanide	100.0	grams
Potassium Bromide	15.0	grams
Sodium Chloride	20.0	grams
Water to	1.0	liter

FIX

Calgon	1.0	gram
Sodium Thiosulfate	200.0	grams
Sodium Sulfite	10.0	grams
Water to	1.0	liter

OFFICIAL KODAK PROCESSING FORMULAS FOR KODACHROME COLOR FILM TYPE 5268

Step	Solution	Time
1.	Prehardener	2 min
2.	Wash	2.5 min
3.	First Developer	15 min
4.	Wash	5 min
4A	NOTE: Red light exposure through the base (Corning 2410 filter 3mm thick) approximately 2,000 ft. candles.	
5.	Cyan Developer	10 min
6.	Wash	2.5 min
7.	Auxiliary Developer	2.5 min
8.	Wash	5 min
8A.	NOTE: Blue light exposure emulsion side (Wratten 39 filter 2mm thick) approximately 5,500 ft. candles.	
9.	Yellow Developer	8 min
10.	Wash	2.5 min
11.	Auxiliary Developer	2.5 min
12.	Wash	5 min
13.	Magenta Developer	8 min
14.	Wash	7.5 min
15.	Bleach	5 min
16.	Fix	2.5 min
17.	Wash	7.5 min
18.	Dry	25 min

NOTE: All solutions at 70°f.

PREHARDENER

Calgon	.6	gram
Sodium Carbonate (mono.)	5.0	grams
Sodium Bisulfite	5.0	grams
Sodium Sulfate (anhy.)	150.0	grams
Potassium Bromide	1.0	gram
Formalin	30.0	cc
Water to	1.0	liter

OFFICIAL KODAK PROCESSING
KODACHROME TYPE 5268

FIRST DEVELOPER

Calgon	.6	gram	
Sodium Sulfite (anhy.)	8.5	grams	
Elon (DD-4)	4.0	grams	
Hydroquinone (DD-14)	1.10	grams	
Sodium Carbonate	30.0	grams	
Sodium Sulfite	45.0	grams	
Potassium Bromide	15.0	grams	
5-nitroindazole (0.5% sol.)	5.0	cc	(See note #1)*
Potassium Iodide (0.1% sol.)	10.0	cc	
Isopropylamine	6.5	grams	(See note #2)
Water to	1.0	liter	

See Note "A"

CYAN DEVELOPER

Calgon	.6	gram	
Foamex	.2	cc	(See note #3)
Alkanol B	.2	gram	(See note #3)
Sodium Sulfite (anhy.)	5.0	grams	
Resorcinol	.150	gram	(See note #4)
2 amino-5-diethylamino-toluene hydrochloride (CD-2 or DD-2)	2.9	grams	
Sodium Carbonate (mono.)	15.0	grams	
Potassium Bromide	2.5	grams	
Potassium Iodide (0.1% sol.)	2.0	cc	
Sodium Hydroxide	2.75	grams	
6-nitrobenzimidazole nitrate	.18	gram	
2, 4-dichloro-5-p-toluene sulfonylamino-1-naphthol	1.35	gram	(See note #5)
Water to	1.0	liter	

See Note "B"

AUXILIARY DEVELOPERS 1 AND 2

Calgon	.6	gram	
Sodium Sulfite (anhy.)	8.5	grams	
Elon (DD-4)	4.0	grams	
Hydroquinone (DD-14)	1.4	grams	
Sodium Carbonate (mono.)	26.0	grams	
Sodium Sulfite	45.0	grams	
Potassium Bromide	4.5	grams	
5-nitroindazole (0.5% sol.)	4.0	cc	(See note #1)
Potassium Iodide (0.1% sol.)	8.0	cc	
Water to	1.0	liter	

*Notes for both systems appear on page N-291

OFFICIAL KODAK PROCESSING
KODACHROME TYPE 5268

YELLOW DEVELOPER

Calgon	.6	gram
Sodium Sulfite	10.0	grams
p-aminodiethylaniline hydrochloride (DD-6)	2.30	grams
Sodium Carbonate (mono.)	20.0	grams
Potassium Bromide	1.5	gram
Potassium Iodide (0.1% sol.)	1.5	cc
Sodium Hydroxide	1.7	cc
4-p-toluene sulfonylamino-omega-benzoylacetanilide	1.15	gram (See note #6)
Water to	1.0	liter

MAGENTA DEVELOPER

Calgon	.6	gram
Sodium Sulfite	6.0	grams
2-amino-5-diethylamino toluene hydrochloride (DD-2 or CD-2)	1.05	grams
Sodium Sulfate	40.0	grams
Sodium Thiocyanate	3.0	grams
Ethylene Diamine (68%)	5.0	cc
Sodium Carbonate (mono.)	40.0	grams
Potassium Bromide	1.10	gram
Sodium Hydroxide	1.5	gram
2-cyanoacetylcoumarone	.95	gram (See note #7)
Potassium Iodide (0.1% sol.)	2.0	cc
Water to	1.0	liter

BLEACH

Calgon	.6	gram
Potassium Ferricyanide	130.0	grams
Potassium Bromide	15.0	grams
Borax ($10H_20$)	10.0	grams
Boric Acid	5.0	grams
Sodium Chloride	26.0	grams
Water to	1.0	liter

FIX

Calgon	1.0	gram
Sodium Sulfite (anhy.)	10.0	grams
Sodium Thiosulfate	200.00	grams
Water to	1.0	liter

KODACHROME

NOTE "A"

If you will check over both first developers, you will note that neither contain thiocyanate which is the silver halide solvent customarily used in all first developers in reversal systems. According to the literature on Kodachrome, the amount of thiocyanate is extremely critical. It is usually at least one gram and not more than two grams per liter. If not enough is used, the result will be slow foot speed and very high minimum density. This can also effect the re-exposure of the bottom layer.

Because of iodide accumulation in the solution (released by the film), fresh solutions are compounded with a small amount of iodide added. This is one reason you will find iodide in any number of color developing solutions. It has recently been discovered that small amounts of iodide help to prevent stain of processed and stored microfilm emulsions. Whether this applies to Kodachrome, we do not know. The first developer increases the density of the bottom layer by physical development and it is therefore necessary to measure the density of the bottom layer after first development to determine the amount of re-exposure necessary for the bottom layer. This is done with an infra-red scope similar to a "snooper scope" used by the Army.

The red sensitivity dye in the bottom emulsion peaks at 6500Å. The thiocyanate content of the first developer may cause this dye to slightly diffuse into the middle green layer. If this happens, the sensitivity peak of the red dye changes to approximately 6000Å. This is the reason for the very narrow cutting red filter which peaks between 6300Å and 6400Å.

NOTE "B"

The activity of the cyan developer is sometimes increased or accelerated using Phenidone or Metol. Note that Resorcinol is used in the 5268 cyan developer and that BD-80 is used in the 5265 cyan developer (see notes number 4 and 8). These serve the same purpose.

These weak developing agents tend to decrease the chance of "cyan fogging" in the middle green layer. They also help prevent aerial oxidation which is always a problem with any color coupler which cannot tolerate a large amount of sulfite. Sulfite reduces color coupling as it does when an excessive amount is used in any color developing solution.

When the cyan layer is developed to produce maximum density, there is still unexposed silver halide left over in this layer. This sometimes must be developed in a black and white auxiliary type developer or it will color develop in the yellow developing solution.

KODACHROME

NOTE "B" (continued)

Can the information given in these formulas be used to process Kodachromes? Today, Kodachrome is still basically made the same way, however, the chemicals used to sensitize each layer has probably been changed. The emulsion, no doubt, is softer and some of the couplers have been changed.

It must be remembered that Kodak has constantly improved and simplified their Kodachrome process. The newest method makes use of Borohydride as a chemical fogging agent, which eliminates the need to re-expose the middle layer to white light. The present system probably uses citrazinic acid as a means of controlling the amount of dye formed by the different color couplers. (See Newsletter, page L-252 for citrazinic acid patent review.)

NOTE 1

This is Kodaks anti-fog #5. It is also referred to as AF-74.

NOTE 2

Isopropylamine is a colorless, flammable liquid, immersible with water, alcohol and ether. It has a strong ammonia odor. It is a strong base. Its' action in developers would be similar to ethelynediamine.

NOTE 3

Foamex is the trade name of a wetting agent. Alkanol B is also the trade mark for a wetting agent made by Dupont. Surface active agents promote wetting and penetration. Why two wetting agents are used in the cyan color developer we do not know at this time. Perhaps the word "penetrating" is a clue.

NOTE 4

Resorcinal. This is a weak developing agent chemically known as m-DiHydroxy-Benzene. In alkali solutions, this chemical oxidizes to a Hydroxyhydroquinone according to Kendal, Stroud, and Eggers. This was reported at the Zurich Congress in 1961. Henn and Crabtree of Kodak also recommended Resorcinal (.1 to .5%) to prevent sulfide bacteria.

NOTE 5

Note that the cyan coupling agent used is different for each of these two sets of formulas. The cyan couplers used with 5265 is listed by Kodak under the code number C-10. The cyan coupler used in the 5268 is listed as C-11. They list one more cyan coupler - (N o-acetamidophenethyl -1-hydroxy-2-napthamide). This is coded C-12. In case you would like to purchase a 25# drum of C-12 from Kodak, it is listed at $1910.00. We assume this is delivered.

KODACHROME

NOTE 6

Kodak Code Y-50 - (4- p-toluenesulfonylamino- -omega benzoylacetanilide). This yellow coupler is the same in both sets of formulas given. They also list one other yellow coupler called Y-54 which is (Alpha-benzoyl-O-methoxy acetanilide).

NOTE 7

The magenta coupler used in 5268 is listed by Kodak as M-31 (2-cyano-acetyl coumarone). The magenta coupler used in 5265 is 1-(2-benzothrazoyl 1)-3-amino-5-pyrazolone, which is not listed by Kodak, however they do list two new other magenta couplers, M-32 and M-38.

NOTE 8

This is a black and white developing agent. It is listed by Kodak as Kodak Balancing Coupling Agent, BD-80, chemically known as (Mono-Benzyl-Para-Aminophenol Hydrochloride)

Some of the following couplers correspond to the couplers listed in the two sets of formulas given. We also indicated a source for some of the couplers in small amounts for those of you who may wish to experiment. We are listing one substitute magenta coupler which we feel can be used.

KODAK COUPLING AGENTS

C-10 (2,6-Dibromo-1, 5-dihydroxynaphthalene)

C-11 (2,4-Dichloro-5- p-toluenesulfonylamino -1-naphthol)

C-16 (N- o-acetamido phenethyl -1-hydroxy-2-naphthamide)

M-31 (2-Cyanoacetylcoumarone)

M-32 (1-phenyl-3- 3,4-dichlorobenzamido -5-pyrazolone)

M-38 (1- 2,4,6-trichlorophenyl -3-p-nitroanilino-2-pyrazoline-5-one)

Y-50 (4- p-toluenesulfonylamino -omega-benzoylacetanilide)

Y-54 (Alpha-benzoyl-o-methoxy acetanilide)

Pfaltz & Bauer, Inc., 126-02 Northern Blvd., Flushing, N.Y. 11368 list the following couplers in their newest catalog.

MAGENTA COUPLER(same as M-31) 2-cyanoacetylcoumarone, 100g, $20.00
or 2,4-Dichloro -1-naphthol, 100g, $7.00

CYAN COUPLER (same as C-10) 2,6-Dibromo-1 5-dihydroxynaphthalene)
10 g, $7.00

YELLOW COUPLER (same as Y-50) 4-(p-toluenesulfonylamino)-omega-benzoylacetanilide, 100g, $11.00